

```
1: // $Id: astree.h,v 1.7 2016-10-06 16:13:39-07 - - $
2:
3: #ifndef __ASTREE_H__
4: #define __ASTREE_H__
5:
6: #include <string>
7: #include <vector>
8: using namespace std;
9:
10: #include "auxlib.h"
11:
12: struct location {
13:     size_t filenr;
14:     size_t linenr;
15:     size_t offset;
16: };
17:
18: struct astree {
19:
20:     // Fields.
21:     int symbol; // token code
22:     location lloc; // source location
23:     const string* lexinfo; // pointer to lexical information
24:     vector<astree*> children; // children of this n-way node
25:
26:     // Functions.
27:     astree (int symbol, const location&, const char* lexinfo);
28:     ~astree();
29:     astree* adopt (astree* child1, astree* child2 = nullptr);
30:     astree* adopt_sym (astree* child, int symbol);
31:     void dump_node (FILE*);
32:     void dump_tree (FILE*, int depth = 0);
33:     static void dump (FILE* outfile, astree* tree);
34:     static void print (FILE* outfile, astree* tree, int depth = 0);
35: };
36:
37: void destroy (astree* tree1, astree* tree2 = nullptr);
38:
39: void errllocprintf (const location&, const char* format, const char*);
40:
41: #endif
42:
```

```
1: // $Id: astree.cpp,v 1.9 2017-10-04 15:59:50-07 - - $
2:
3: #include <assert.h>
4: #include <inttypes.h>
5: #include <stdarg.h>
6: #include <stdio.h>
7: #include <stdlib.h>
8: #include <string.h>
9:
10: #include "astree.h"
11: #include "string_set.h"
12: #include "lyutils.h"
13:
14: astree::astree (int symbol_, const location& lloc_, const char* info) {
15:     symbol = symbol_;
16:     lloc = lloc_;
17:     lexinfo = string_set::intern (info);
18:     // vector defaults to empty -- no children
19: }
20:
21: astree::~~astree() {
22:     while (not children.empty()) {
23:         astree* child = children.back();
24:         children.pop_back();
25:         delete child;
26:     }
27:     if (yydebug) {
28:         fprintf (stderr, "Deleting astree (");
29:         astree::dump (stderr, this);
30:         fprintf (stderr, ")\n");
31:     }
32: }
33:
34: astree* astree::adopt (astree* child1, astree* child2) {
35:     if (child1 != nullptr) children.push_back (child1);
36:     if (child2 != nullptr) children.push_back (child2);
37:     return this;
38: }
39:
40: astree* astree::adopt_sym (astree* child, int symbol_) {
41:     symbol = symbol_;
42:     return adopt (child);
43: }
44:
```

```
45:
46: void astree::dump_node (FILE* outfile) {
47:     fprintf (outfile, "%p->{%s %zd.%zd.%zd \"%s\":",
48:             this, parser::get_tname (symbol),
49:             lloc.filenr, lloc.linernr, lloc.offset,
50:             lexinfo->c_str());
51:     for (size_t child = 0; child < children.size(); ++child) {
52:         fprintf (outfile, " %p", children.at(child));
53:     }
54: }
55:
56: void astree::dump_tree (FILE* outfile, int depth) {
57:     fprintf (outfile, "%*s", depth * 3, "");
58:     dump_node (outfile);
59:     fprintf (outfile, "\n");
60:     for (astree* child: children) child->dump_tree (outfile, depth + 1);
61:     fflush (nullptr);
62: }
63:
64: void astree::dump (FILE* outfile, astree* tree) {
65:     if (tree == nullptr) fprintf (outfile, "nullptr");
66:     else tree->dump_node (outfile);
67: }
68:
69: void astree::print (FILE* outfile, astree* tree, int depth) {
70:     fprintf (outfile, "; %*s", depth * 3, "");
71:     fprintf (outfile, "%s \"%s\" (%zd.%zd.%zd)\n",
72:             parser::get_tname (tree->symbol), tree->lexinfo->c_str(),
73:             tree->lloc.filenr, tree->lloc.linernr, tree->lloc.offset);
74:     for (astree* child: tree->children) {
75:         astree::print (outfile, child, depth + 1);
76:     }
77: }
78:
79: void destroy (astree* tree1, astree* tree2) {
80:     if (tree1 != nullptr) delete tree1;
81:     if (tree2 != nullptr) delete tree2;
82: }
83:
84: void errllocprintf (const location& lloc, const char* format,
85:                   const char* arg) {
86:     static char buffer[0x1000];
87:     assert (sizeof buffer > strlen (format) + strlen (arg));
88:     snprintf (buffer, sizeof buffer, format, arg);
89:     errprintf ("%s:%zd.%zd: %s",
90:               lexer::filename (lloc.filenr), lloc.linernr, lloc.offset,
91:               buffer);
92: }
```

```
1: // $Id: auxlib.h,v 1.10 2017-10-11 14:33:32-07 - - $
2:
3: #ifndef __AUXLIB_H__
4: #define __AUXLIB_H__
5:
6: #include <string>
7: using namespace std;
8:
9: #include <stdarg.h>
10:
11: //
12: // DESCRIPTION
13: //     Auxiliary library containing miscellaneous useful things.
14: //
15:
16: //
17: // Error message and exit status utility.
18: //
19:
20: struct exec {
21:     static string execname;
22:     static int exit_status;
23: };
24:
25: void veprintf (const char* format, va_list args);
26: // Prints a message to stderr using the vector form of
27: // argument list.
28:
29: void eprintf (const char* format, ...);
30: // Print a message to stderr according to the printf format
31: // specified. Usually called for debug output.
32: // Precedes the message by the program name if the format
33: // begins with the characters `%:'.
34:
35: void errprintf (const char* format, ...);
36: // Print an error message according to the printf format
37: // specified, using eprintf.
38: // Sets the exitstatus to EXIT_FAILURE.
39:
40: void syserrprintf (const char* object);
41: // Print a message resulting from a bad system call. The
42: // object is the name of the object causing the problem and
43: // the reason is taken from the external variable errno.
44: // Sets the exit status to EXIT_FAILURE.
45:
46: void eprint_status (const char* command, int status);
47: // Print the status returned by wait(2) from a subprocess.
48:
```

```
49:
50: //
51: // Support for stub messages.
52: //
53: #define STUBPRINTF(...) \
54:     __stubprintf (__FILE__, __LINE__, __PRETTY_FUNCTION__, \
55:         __VA_ARGS__)
56: void __stubprintf (const char* file, int line, const char* func,
57:     const char* format, ...);
58:
59: //
60: // Debugging utility.
61: //
62:
63: void set_debugflags (const char* flags);
64: // Sets a string of debug flags to be used by DEBUGF statements.
65: // Uses the address of the string, and does not copy it, so
66: // it must not be dangling. If a particular debug flag has
67: // been set, messages are printed. The format is identical to
68: // printf format. The flag "@" turns on all flags.
69:
70: bool is_debugflag (char flag);
71: // Checks to see if a debugflag is set.
72:
73: #ifdef NDEBUG
74: // Do not generate any code.
75: #define DEBUGF(FLAG,...) /**/
76: #define DEBUGSTMT(FLAG,STMTS) /**/
77: #else
78: // Generate debugging code.
79: void __debugprintf (char flag, const char* file, int line,
80:     const char* func, const char* format, ...);
81: #define DEBUGF(FLAG,...) \
82:     __debugprintf (FLAG, __FILE__, __LINE__, __PRETTY_FUNCTION__, \
83:         __VA_ARGS__)
84: #define DEBUGSTMT(FLAG,STMTS) \
85:     if (is_debugflag (FLAG)) { DEBUGF (FLAG, "\n"); STMTS }
86: #endif
87:
88: #endif
89:
```

```
1: // $Id: auxlib.cpp,v 1.5 2017-10-11 14:28:23-07 - - $
2:
3: #include <assert.h>
4: #include <errno.h>
5: #include <libgen.h>
6: #include <limits.h>
7: #include <stdarg.h>
8: #include <stdio.h>
9: #include <stdlib.h>
10: #include <string.h>
11: #include <wait.h>
12:
13: #include "auxlib.h"
14:
15: string exec::execname;
16: int exec::exit_status = EXIT_SUCCESS;
17:
18: const char* debugflags = "";
19: bool alldebugflags = false;
20:
21: static void eprint_signal (const char* kind, int signal) {
22:     eprintf ("", %s %d", kind, signal);
23:     const char* sigstr = strsignal (signal);
24:     if (sigstr != nullptr) fprintf (stderr, " %s", sigstr);
25: }
26:
27: void eprint_status (const char* command, int status) {
28:     if (status == 0) return;
29:     eprintf ("%s: status 0x%04X", command, status);
30:     if (WIFEXITED (status)) {
31:         eprintf ("", exit %d", WEXITSTATUS (status));
32:     }
33:     if (WIFSIGNALED (status)) {
34:         eprint_signal ("Terminated", WTERMSIG (status));
35:         #ifdef WCOREDUMP
36:         if (WCOREDUMP (status)) eprintf ("", core dumped");
37:         #endif
38:     }
39:     if (WIFSTOPPED (status)) {
40:         eprint_signal ("Stopped", WSTOPSIG (status));
41:     }
42:     if (WIFCONTINUED (status)) {
43:         eprintf ("", Continued");
44:     }
45:     eprintf ("\n");
46: }
47:
48: void veprintf (const char* format, va_list args) {
49:     assert (exec::execname.size() != 0);
50:     assert (format != nullptr);
51:     fflush (nullptr);
52:     if (strstr (format, "%:") == format) {
53:         fprintf (stderr, "%s: ", exec::execname.c_str());
54:         format += 2;
55:     }
56:     vfprintf (stderr, format, args);
57:     fflush (nullptr);
58: }
```

```
59:
60: void eprintf (const char* format, ...) {
61:     va_list args;
62:     va_start (args, format);
63:     vprintf (format, args);
64:     va_end (args);
65: }
66:
67: void errprintf (const char* format, ...) {
68:     va_list args;
69:     va_start (args, format);
70:     vprintf (format, args);
71:     va_end (args);
72:     exec::exit_status = EXIT_FAILURE;
73: }
74:
75: void syserrprintf (const char* object) {
76:     errprintf ("%s: %s\n", object, strerror (errno));
77: }
78:
79: void __stubprintf (const char* file, int line, const char* func,
80:                  const char* format, ...) {
81:     va_list args;
82:     fflush (nullptr);
83:     printf ("%s: %s[%d] %s: ", exec::execname.c_str(), file, line, func);
84:     va_start (args, format);
85:     vprintf (format, args);
86:     va_end (args);
87:     fflush (nullptr);
88: }
89:
```

```
90:
91: void set_debugflags (const char* flags) {
92:     debugflags = flags;
93:     assert (debugflags != nullptr);
94:     if (strchr (debugflags, '@') != nullptr) alldebugflags = true;
95:     DEBUGF ('x', "Debugflags = \"%s\", all = %d\n",
96:             debugflags, alldebugflags);
97: }
98:
99: bool is_debugflag (char flag) {
100:     return alldebugflags or strchr (debugflags, flag) != nullptr;
101: }
102:
103: void __debugprintf (char flag, const char* file, int line,
104:                    const char* func, const char* format, ...) {
105:     va_list args;
106:     if (not is_debugflag (flag)) return;
107:     fflush (nullptr);
108:     va_start (args, format);
109:     fprintf (stderr, "DEBUGF(%c): %s[%d] %s():\n",
110:             flag, file, line, func);
111:     vfprintf (stderr, format, args);
112:     va_end (args);
113:     fflush (nullptr);
114: }
115:
```



```
1: // $Id: lyutils.h,v 1.11 2017-10-11 14:19:04-07 - - $
2:
3: #ifndef __UTILS_H__
4: #define __UTILS_H__
5:
6: // Lex and Yacc interface utility.
7:
8: #include <string>
9: #include <vector>
10: using namespace std;
11:
12: #include <stdio.h>
13:
14: #include "astree.h"
15: #include "auxlib.h"
16:
17: #define YYEOF 0
18:
19: extern FILE* yyin;
20: extern char* yytext;
21: extern int yy_flex_debug;
22: extern int yydebug;
23: extern size_t yyleng;
24:
25: int yylex();
26: int yylex_destroy();
27: int yyparse();
28: void yyerror (const char* message);
29:
30: struct lexer {
31:     static bool interactive;
32:     static location lloc;
33:     static size_t last_yyleng;
34:     static vector<string> filenames;
35:     static const string* filename (int filenr);
36:     static void newfilename (const string& filename);
37:     static void advance();
38:     static void newline();
39:     static void badchar (unsigned char bad);
40:     static void badtoken (char* lexeme);
41:     static void include();
42: };
43:
44: struct parser {
45:     static astree* root;
46:     static const char* get_tname (int symbol);
47: };
48:
49: #define YYSTYPE_IS_DECLARED
50: typedef astree* YYSTYPE;
51: #include "yyparse.h"
52:
53: #endif
54:
```

```
1: // $Id: lyutils.cpp,v 1.11 2016-10-06 16:42:53-07 - - $
2:
3: #include <assert.h>
4: #include <ctype.h>
5: #include <stdio.h>
6: #include <stdlib.h>
7: #include <string.h>
8:
9: #include "auxlib.h"
10: #include "lyutils.h"
11:
12: bool lexer::interactive = true;
13: location lexer::lloc = {0, 1, 0};
14: size_t lexer::last_yyleng = 0;
15: vector<string> lexer::filenames;
16:
17: astree* parser::root = nullptr;
18:
19: const string* lexer::filename (int filenr) {
20:     return &lexer::filenames.at(filenr);
21: }
22:
23: void lexer::newfilename (const string& filename) {
24:     lexer::lloc.filenr = lexer::filenames.size();
25:     lexer::filenames.push_back (filename);
26: }
27:
28: void lexer::advance() {
29:     if (not interactive) {
30:         if (lexer::lloc.offset == 0) {
31:             printf (";%2zd.%3zd: ",
32:                 lexer::lloc.filenr, lexer::lloc.linernr);
33:         }
34:         printf ("%s", yytext);
35:     }
36:     lexer::lloc.offset += last_yyleng;
37:     last_yyleng = yylen;
38: }
39:
40: void lexer::newline() {
41:     ++lexer::lloc.linernr;
42:     lexer::lloc.offset = 0;
43: }
44:
45: void lexer::badchar (unsigned char bad) {
46:     char buffer[16];
47:     snprintf (buffer, sizeof buffer,
48:         isgraph (bad) ? "%c" : "\\%03o", bad);
49:     errllocprintf (lexer::lloc, "invalid source character (%s)\n",
50:         buffer);
51: }
52:
```

```
53:
54: void lexer::badtoken (char* lexeme) {
55:     errllocprintf (lexer::lloc, "invalid token (%s)\n", lexeme);
56: }
57:
58: void lexer::include() {
59:     size_t linenr;
60:     static char filename[0x1000];
61:     assert (sizeof filename > strlen (yytext));
62:     int scan_rc = sscanf (yytext, "# %zd \"%^[^\"]\"", &linenr, filename);
63:     if (scan_rc != 2) {
64:         errprintf ("%s: invalid directive, ignored\n", yytext);
65:     } else {
66:         if (yy_flex_debug) {
67:             fprintf (stderr, "--included # %zd \"%s\"\n",
68:                     linenr, filename);
69:         }
70:         lexer::lloc.linenr = linenr - 1;
71:         lexer::newfilename (filename);
72:     }
73: }
74:
75: void yyerror (const char* message) {
76:     assert (not lexer::filenames.empty());
77:     errllocprintf (lexer::lloc, "%s\n", message);
78: }
79:
```

```
1: // $Id: string_set.h,v 1.1 2016-10-06 16:15:22-07 - - $
2:
3: #ifndef __STRING_SET__
4: #define __STRING_SET__
5:
6: #include <string>
7: #include <unordered_set>
8: using namespace std;
9:
10: #include <stdio.h>
11:
12: struct string_set {
13:     string_set();
14:     static unordered_set<string> set;
15:     static const string* intern (const char*);
16:     static void dump (FILE*);
17: };
18:
19: #endif
20:
```

```
1: // $Id: string_set.cpp,v 1.3 2017-10-11 14:24:08-07 - - $
2:
3: #include <string>
4: #include <unordered_set>
5: using namespace std;
6:
7: #include "auxlib.h"
8: #include "string_set.h"
9:
10: unordered_set<string> string_set::set;
11:
12: string_set::string_set() {
13:     set.max_load_factor (0.5);
14: }
15:
16: const string* string_set::intern (const char* string) {
17:     auto handle = set.insert (string);
18:     DEBUGF ('s', "inserted \"%s\" %s\n", handle.first->c_str(),
19:             handle.second ? "newly inserted" : "already there");
20:     return &*handle.first;
21: }
22:
23: void string_set::dump (FILE* out) {
24:     static unordered_set<string>::hasher hash_fn
25:         = string_set::set.hash_function();
26:     size_t max_bucket_size = 0;
27:     for (size_t bucket = 0; bucket < set.bucket_count(); ++bucket) {
28:         bool need_index = true;
29:         size_t curr_size = set.bucket_size (bucket);
30:         if (max_bucket_size < curr_size) max_bucket_size = curr_size;
31:         for (auto itor = set.cbegin (bucket);
32:              itor != set.cend (bucket); ++itor) {
33:             if (need_index) fprintf (out, "string_set[%4zu]: ", bucket);
34:             else fprintf (out, "          %4s ", "");
35:             need_index = false;
36:             const string* str = &*itor;
37:             fprintf (out, "%22zu %p->\"%s\"\\n", hash_fn(*str),
38:                     str, str->c_str());
39:         }
40:     }
41:     fprintf (out, "load_factor = %.3f\\n", set.load_factor());
42:     fprintf (out, "bucket_count = %zu\\n", set.bucket_count());
43:     fprintf (out, "max_bucket_size = %zu\\n", max_bucket_size);
44: }
45:
```

```
1: /* A Bison parser, made by GNU Bison 3.0.4.  */
2:
3: /* Bison interface for Yacc-like parsers in C
4:
5:    Copyright (C) 1984, 1989-1990, 2000-2015 Free Software Foundation, In
c.
6:
7:    This program is free software: you can redistribute it and/or modify
8:    it under the terms of the GNU General Public License as published by
9:    the Free Software Foundation, either version 3 of the License, or
10:   (at your option) any later version.
11:
12:   This program is distributed in the hope that it will be useful,
13:   but WITHOUT ANY WARRANTY; without even the implied warranty of
14:   MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
15:   GNU General Public License for more details.
16:
17:   You should have received a copy of the GNU General Public License
18:   along with this program.  If not, see <http://www.gnu.org/licenses/>.
*/
19:
20: /* As a special exception, you may create a larger work that contains
21:    part or all of the Bison parser skeleton and distribute that work
22:    under terms of your choice, so long as that work isn't itself a
23:    parser generator using the skeleton or a modified version thereof
24:    as a parser skeleton.  Alternatively, if you modify or redistribute
25:    the parser skeleton itself, you may (at your option) remove this
26:    special exception, which will cause the skeleton and the resulting
27:    Bison output files to be licensed under the GNU General Public
28:    License without this special exception.
29:
30:    This special exception was added by the Free Software Foundation in
31:    version 2.2 of Bison.  */
32:
33: #ifndef YY_Y_YYPARSE_H_INCLUDED
34: # define YY_Y_YYPARSE_H_INCLUDED
35: /* Debug traces.  */
36: #ifndef YYDEBUG
37: # define YYDEBUG 1
38: #endif
39: #if YYDEBUG
40: extern int yydebug;
41: #endif
42:
43: /* Token type.  */
44: #ifndef YYTOKENTYPE
45: # define YYTOKENTYPE
46:   enum yytokentype
47:   {
48:     TOK_VOID = 258,
49:     TOK_INT = 259,
50:     TOK_STRING = 260,
51:     TOK_IF = 261,
52:     TOK_ELSE = 262,
53:     TOK_WHILE = 263,
54:     TOK_RETURN = 264,
55:     TOK_STRUCT = 265,
56:     TOK_NULL = 266,
```

```
57:     TOK_NEW = 267,
58:     TOK_ARRAY = 268,
59:     TOK_ARROW = 269,
60:     TOK_EQ = 270,
61:     TOK_NE = 271,
62:     TOK_LT = 272,
63:     TOK_LE = 273,
64:     TOK_GT = 274,
65:     TOK_GE = 275,
66:     TOK_NOT = 276,
67:     TOK_IDENT = 277,
68:     TOK_INTCON = 278,
69:     TOK_CHARCON = 279,
70:     TOK_STRINGCON = 280,
71:     TOK_ROOT = 281,
72:     TOK_BLOCK = 282,
73:     TOK_CALL = 283,
74:     TOK_IFELSE = 284,
75:     TOK_INITDECL = 285,
76:     TOK_POS = 286,
77:     TOK_NEG = 287,
78:     TOK_NEWARRAY = 288,
79:     TOK_TYPEID = 289,
80:     TOK_FIELD = 290
81: };
82: #endif
83:
84: /* Value type. */
85: #if ! defined YYSTYPE && ! defined YYSTYPE_IS_DECLARED
86: typedef int YYSTYPE;
87: # define YYSTYPE_IS_TRIVIAL 1
88: # define YYSTYPE_IS_DECLARED 1
89: #endif
90:
91:
92: extern YYSTYPE yylval;
93:
94: int yyparse (void);
95:
96: #endif /* !YY_Y_YYPARSE_H_INCLUDED */
```

```
1: %{
2: // $Id: parser.y,v 1.18 2018-10-25 13:08:35-07 - - $
3: // Dummy parser for scanner project.
4:
5: #include <cassert>
6:
7: #include "lyutils.h"
8: #include "astree.h"
9:
10: %}
11:
12: %debug
13: %defines
14: %error-verbose
15: %token-table
16: %verbose
17:
18: %token TOK_VOID TOK_INT TOK_STRING
19: %token TOK_IF TOK_ELSE TOK_WHILE TOK_RETURN TOK_STRUCT
20: %token TOK_NULL TOK_NEW TOK_ARRAY TOK_ARROW
21: %token TOK_EQ TOK_NE TOK_LT TOK_LE TOK_GT TOK_GE TOK_NOT
22: %token TOK_IDENT TOK_INTCON TOK_CHARCON TOK_STRINGCON
23:
24: %token TOK_ROOT TOK_BLOCK TOK_CALL TOK_IFELSE TOK_INITDECL
25: %token TOK_POS TOK_NEG TOK_NEWARRAY TOK_TYPEID TOK_FIELD
26:
27: %start program
28:
29: %%
30:
31: program : program token | ;
32: token   : '(' | ')' | '[' | ']' | '{' | '}' | ';' | ',' |
33:          | '=' | '+' | '-' | '*' | '/' | '%' | TOK_NOT
34:          | TOK_ROOT TOK_VOID | TOK_INT | TOK_STRING
35:          | TOK_IF | TOK_ELSE | TOK_WHILE | TOK_RETURN | TOK_STRUCT
36:          | TOK_NULL | TOK_NEW | TOK_ARRAY | TOK_ARROW
37:          | TOK_EQ | TOK_NE | TOK_LT | TOK_LE | TOK_GT | TOK_GE
38:          | TOK_IDENT | TOK_INTCON | TOK_CHARCON | TOK_STRINGCON
39:          ;
40:
41: %%
```



```
42:
43:
44: const char *parser::get_tname (int symbol) {
45:     return yytname [YYTRANSLATE (symbol)];
46: }
47:
48:
49: bool is_defined_token (int symbol) {
50:     return YYTRANSLATE (symbol) > YYUNDEFTOK;
51: }
52:
```